

REMARKS

In the Office Action, the Examiner rejected Claims 1-18, which were all of the then pending claims, under 35 U.S.C. 103 as being unpatentable over the prior art, principally U.S. Patents 6,269,322 (Templeton) and 6,498,352 (Nishi). Claims 1-11 were further rejected under 35 U.S.C. 101 as directed to non-statutory subject matter.

With respect to the rejection of the claims under 35 U.S.C. 103, Claims 1-5, 8-14 and 16-18 were rejected as being unpatentable over Templeton in view of Nishi; and Claims 6, 7 and 15 were rejected as being unpatentable over Templeton and Nishi in view of U.S. Patent 5,734,594 (Chu, et al.).

In this Amendment, independent Claims 1, 8, 12 and 16 are being amended to emphasize the differences between the claims and the prior art. Also, new Claim 19, which is dependent from Claim 1, is being added to describe preferred or optional features of the invention.

For the reasons set forth below, Claims 1-11 are directed to statutory subject matter, and all of Claims 1-18 patentably distinguish over the prior art and are allowable. Accordingly, the Examiner is respectfully requested to reconsider and to withdraw the rejection of Claims 1-11 under 35 U.S.C. 101 and the rejections of Claims 1-18 under 35 U.S.C. 103, and to allow claims 1-19.

The rejection of Claims 1-11 under 35 U.S.C. 101 is respectfully traversed.

In rejecting these claims as directed to non-statutory subject matter, the Examiner, in the Office Action, argued that a determination of grid parameters or offset is not concrete and tangible per se. Applicants respectfully disagree.

Grid parameters or offset are known and understood features. These features are, for instance, the grid placement errors, such as grid magnification and rotation calibration, and are real

and have a material, perceptible existence. Grid parameters and offsets are actual and can be measured, and these features are not mere abstracts or ideas. Also, these features have a real and tangible effect on the operation of photolithography tools and on the manufacture of semiconductor devices.

Independent Claim 1 is directed to a method for calibrating grid parameters for a photolithographic tool, and this claim sets forth the step of using a determined distance between a measured and a known distance to determine the grid parameters of a wafer stage of the photolithographic tool, independent of field parameters of that tool. Independent Claim 8 defines a method for determining grid parameters for a photolithographic tool, and this claim includes the step of using a measured offset between first and second structures to determine the grid parameters of a wafer stage of the photolithography tool.

Because of the real, measurable, practical nature of grid parameters and offsets, and because, in practice, they have a physical effect on the operation of a photolithographic tool, these parameters and offset are concrete and tangible. Accordingly, Claims 1 and 8, and the dependent Claims 2-7 and 8-11, are directed to statutory subject matter within 35 U.S.C. 101. The Examiner is thus asked to reconsider and to withdraw the rejection of Claims 1-11 under 35 U.S.C. 101.

In addition, Claims 1-19 patentably distinguish over the prior art because the prior art does not disclose or suggest the feature of determining the grid parameters, including grid magnification and rotation calibration, independent of the field parameters of the photolithographic tool.

To elaborate, the instant invention relates to determining grid parameters for a photolithography tool, and more specifically, to determining those parameters independent of the field parameters of the tool. As is understood in the art, integrated circuits require multiple layers

that need to be correctly placed relative to each other. To accomplish this, steppers are used to move the wafers, and these steppers include an alignment system to help achieve the proper relative placement of the layers of the circuit.

The very first level that is printed on the wafer does not have access to alignment marks, however. As a result, that first level is exposed without the use of the alignment system. In order to obtain optimum overlay for subsequent levels, it is very important that the first level formed on the wafer be exposed with known placement characteristics. To achieve this, it is important that field systematic parameters match the associated grid parameters, and that the first level placement characteristics be consistent from lot to lot.

The present invention addresses these issues by determining or measuring grid parameters, in a photolithography procedure, independently of field terms. In the preferred embodiment of this invention, by positioning artifacts on a wafer stage a known distance apart and outside of the area of that wafer stage on which the wafer substrate is placed.

In one embodiment, the distance between these artifacts is measured using the alignment system of the photolithographic tool, and the difference between this measured distance and the known distance between the artifacts is used to determine the grid parameters of the wafer stage of the photolithographic tool, independent of field parameters of that tool.

In another embodiment, the artifacts are used to form first and second structures on the wafer, the offset between those structures is determined, and this determined offset is then used to determine the grid parameters.

Templeton, et al, discloses a procedure for aligning a reticle or mask with a wafer. In this procedure, a reticle is provided with first and second alignment marks, which are used to form two

alignment marks on the wafer. The center of these marks on the wafer is used as a reference point for wafer alignment. Apparently, any reticle rotation error or lens magnification error that occurs when forming the two alignment marks on the wafer offset each other so that the center of these two marks on the wafer is in the intended position, and thus can be used to achieve accurate alignment.

Nishi also describes a procedure for patterning semiconductor wafers. In this procedure, an exposing light is directed through a mask and onto the wafer, copying the mask pattern onto the wafer. This procedure is specifically intended to improve the alignment between the mask and the wafer. As part of this process, and with reference to Figure 1 of Nishi, a reference mark plate 6 is located outside of wafer 5 to help align reticle 12 with the mask.

In the Office Action, the Examiner argued that it would have been obvious to modify the system of Templeton, et al, in view of the teachings of Nishi, to use stage alignment marks instead of reticle alignment marks.

Applicants do not agree with this contention of the Examiner. The reticle alignment marks of Templeton, et al. are necessary because these marks are used to form the alignment marks on the wafer. If the stage alignment marks of Nishi were substituted for the reticle alignment marks of Templeton, et al, then the resulting system would not be able to form the alignment marks on the wafer, which is an integral part of the Templeton, et al. process. Thus, it would not have been obvious to one of ordinary skill in the art to combine the two references as the Examiner has done.

Moreover, even if Templeton, et al. and Nishi were combined as the Examiner has, the resulting method and system would still be different from the present invention in several important respects. In particular, the resulting combination would not determine the grid parameters of the photolithography tool, independent of the field parameters of that tool.

It is important to note that both Templeton, et al. and Nishi relates to wafer alignment, and neither of these references teach determining grid parameters of the photolithographic tool, independent of the field parameters of the tool, which is what the present invention does. Thus, even if Templeton, et al. and Nishi are combined, the combined references still lack an important teaching of the present invention. It thus cannot be said that these references suggests the present invention.

Independent Claims 1, 8, 12 and 16 are being amended to emphasize this feature of the present invention. In particular, Claims 1 and 12 describe the features of determining the distance between the measured and known distances between the artifacts on the wafer stage, and using this determined distance to determine the grid parameters, including grid magnification and rotation calibration, of the photolithographic tool, independent of the field parameters of that tool.

Claims 8 and 16 are directed to the embodiment of the invention in which the artifacts are used to form structures that are then used to determine the grid parameters. These claims describe the features of measuring the offset between the first and second formed structures, and using that measured offset to determine the grid parameters, including grid magnification and rotation calibration, independent of the field parameters.


The other references of record have been reviewed, and these other references, whether considered individually or in combination, also do not disclose or suggest this aspect of the present invention.

For example, Chu was cited for its disclosure of artifacts and for measuring distances between these artifacts. Chu, in column 1, lines 21-25, expressly indicates, though, that the artifacts shown in Figure 1A are on wafer W. Because of this, Chu, like Templeton, et al. actually teaches away from the present invention.

Due to the above-discussed differences between Claims 1, 8, 12 and 16 and the prior art, and due to the advantages of those differences, it cannot be said that any of Claims 1, 8, 12 and 16 is obvious in view of that prior art. Thus, these Claims 1, 8, 12 and 16 patentably distinguish over the prior art, and are allowable. Claims 2-7 and 19 are dependent from Claim 1 and are allowable therewith; and Claims 9-11 are dependent from, and are allowable with, Claim 8. Also, Claims 13-15 are dependent from, and are allowable with, Claim 12, and Claims 17 and 18 are dependent from Claim 16 and are allowable therewith.

For the reasons set forth above, the Examiner is asked to reconsider and to withdraw the rejection of Claims 1-11 under 35 U.S.C. 101 and the rejections of Claims 1-18 under 35 U.S.C. 103, and to allow these Claims and new Claim 19. If the Examiner believes that a telephone conference with Applicants' Attorneys would be advantageous to the disposition of this case, the Examiner is requested to telephone the undersigned.

Respectfully submitted,


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